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25 October 1985

Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH, AND DEVELOPMENT

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WORLDWIDE REPORT

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

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NTT, U.S. TELECOMMUNICATIONS FIRMS CONFER

OW190405 Tokyo KYODO in English 0339 GMT 19 Sep 85

[Text] Washington, 18 Sep (KYODO)--The head of Japan's Nippon Telegraph and Telephone Corp. (NTT) said here Wednesday that his company and American telecommunications firms will begin feasibility studies shortly on NTT purchases of U.S.-made digital switchboards, indicating some development in bilateral efforts to counter technical problems in adapting U.S. equipment to Japanese use. NTT President Hisashi Shinto told a press conference, however, that it will take more time before a contract is signed. "NTT purchases of American telecommunications equipment will not be expanded greatly in a short period of time," Shinto said.

He said Japan has only recently begun importing telecommunications equipment, adding that the part of the trade friction between the two countries centering on telecommunications has resulted partly from the fact that the two nations have not fully understood each other's telecommunications market.

Meanwhile, U.S. Trade Representative Clayton Yeutter expressed dissatisfaction about sluggish NTT purchases of U.S. telecommunications products over the previous year, urging more procurement by NTT. In a seminar sponsored by NTT, Yeutter said the U.S. Government Administration is strongly against protectionist trade bills aimed at Japan now under discussion in Congress.

Yeutter urged U.S. companies to be patient in selling their products on the Japanese market and added that they have to tailor their products to Japanese requirements.

CSO: 5560/005

PRIORITY TELECOMMUNICATIONS PROJECTS IN EDZS OUTLINED

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 6 Jul 85 p 3

[Interview with Wu Jichuan, vice minister of posts and telecommunications, by Lu Zhenhua [7120 2182 3478] and Shang Cuiyun [1424 5050 0061]: "Economic Development Zones Enjoy Priority in Telecommunications Construction"; date of interview not given]

[Text] We went to interview Wu Jichuan [0702 1015 0278], vice minister of posts and telecommunications, as soon as he returned to Beijing from a trip to the open cities of Lianyungang, Nantong, Wanzhou, Fuzhou and Xiamen, where he inspected posts and telecommunications construction. He said excitedly, "Wherever I went, the state of posts and telecommunications development was very gratifying. Some sophisticated imported equipment has been put into service; a number of old post offices in urban areas have been totally renovated, and many telecommunications projects are being built round the clock." He added confidently that residents in the 4 special economic zones [SEZs] and 14 open cities would be able to enjoy automatic or semi-automatic telephone and telegram service within this year. Some users will be able to make direct calls or send telegrams at home or in their office to certain nations, regions and large and medium-sized cities in China. They will find such newly installed and advanced equipment as programmed telephones and mobile telephones highly convenient.

As coastal cities are further opened to the world, the Ministry of Posts and Telecommunications has adopted a preferential policy to give them priority in investments, projects and technology import in order to support their telecommunications construction. According to statistics, 44 percent of the funds earmarked for capital construction in posts and telecommunications in 1984 and 1985 have been spent in SEZs and open cities. Key projects include the 1,800-channel carrier project linking Beijing, Wuhan and Guangzhou, and more than 10 cable multi-microwave communications projects linking Nanjing and Shanghai, Shenyang and Dalian, Hangzhou and Fuzhou, Guangzhou, Zhanjiang and Haikou, Guangzhou and Shantou and Jinan and Qingdao. Some of these projects have been put into operation. It is projected that by the end of 1985, there will be a 42-percent increase over 1983 in local telephones in the SEZs and open cities, a 68-percent increase in long-distance circuits, and a 168-percent increase in cable exchanges.

To accelerate telecommunications construction in the SEZs and open cities, the ministry has discarded its old exclusive reliance on state capital and the monopolistic approach toward posts and telecommunications work. Instead, it has entered into joint investment and construction with local governments and relevant agencies. It has also involved users in raising funds, joint-capital management, and systematically attracted foreign capital and imported technology. Of the eight key communications projects in Fujian Province from 1980 through 1984, four were joint ventures between posts and telecommunications agencies and local authorities. Fujian also imported the nation's first programmed telephone exchange system which more than doubled Fuzhou's telephone capacity. Over 3,000 households have been equipped with telephones. It used to take more than 20 minutes to make a call from Fuzhou to Hong Kong; now the waiting period has been reduced to 9 minutes. Since an imported programmed telephone system went into operation in Xiamen, a telephone user can make direct calls anytime to Hong Kong and a dozen cities like Beijing, Shanghai and Fuzhou, even to places in Japan and the United States. With 14,000 telephones, Shenzhen today has the highest telephone density in the nation. The computerized telephone system recently put into use is multi-functional, providing such services as push-button dialing, automatic wake-up calls, three-way communication, and hot-line service. Armed with a handset, you can go anywhere in the city and still be able to know who is looking for you from the digital display. In addition, posts and telecommunications agencies are vigorously using new technology and expanding the scope of their operations to provide services for the economy and for the SEZs and open cities. The vice minister finally said that although posts and telecommunications construction has made greater progress in the past few years than at any other period, our telecommunications capability still lags behind rapidly increasing social needs. Posts and telecommunications agencies, therefore, must develop a sense of urgency and step up their capability as soon as possible so that telecommunications in SEZs and open cities will improve with each passing day to the benefit of the investment environment.

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PEOPLE'S REPUBLIC OF CHINA

OPTIMAL TRANSFER FUNCTION FOR FIBER OPTIC COMMUNICATIONS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 2, Mar 85 pp 11-12

[Article by Zhou Shunqin [0719 7311 2953], Wuhan Posts and Telecommunications Research Institute: "Approximation and Realization of an Optimal Transfer Function for a Full Response Digital Optic Fiber Communications Receiver"]

[Text] Abstract: This article presents an approximation and realization method for an optimal transfer function for a full response digital optic fiber communications receiver; it provides circuit types that approximate realization of an optimal transfer function for an optical receiver in an optic fiber communications system of low and high dispersion; and we have constructed a variable equalization circuit that allows an optical receiver to approximate an optimal transfer function for fiber optic lines of different bandwidths. This article presents a design example of a 1.3μm, 34 Mb/s optical receiver designed with this method and the results of actual tests. This receiver has already been put into operation with good results in an experimental optic fiber communications system with relays at 26.4 km and in the [illegible].6 km functional 34 Mb/s optic cable communications section built by the Wuhan Municipal Department of Telecommunications.

I. Introduction

We used a practical digital optic fiber communications system using a full response base band transmission method, the structure of which is shown in figure 1. Under the conditions of a given transmitted optic pulse wave form and luminous power transfer function for fiber optic lines, to ensure an optimal system we must design and implement an optical receiver with low noise and no intersymbol interference. The approach upon which we decided was: to design and implement a low noise, high dynamic range optical receiver frontend circuit[1,2]; to construct an optimized optical receiver transmission function, and to generate periodically transmitted pulse wave forms most suitable to digital decision circuits and no intersymbol interference. We will not discuss in depth the latter at present.

```
digital
signal           -----------      |-----|     ---------       --------
input          | optic       |    | optic |  | optical  |    | decision |      digital
-----------> | transmitter |--->| fiber |--->| receiver |--->| circuits | --->signal
               -----------      | line  |     ---------       --------        output
                                 -----
```

$h_{in}(t)$ $h_t(t)$ $h_f(t)$ $h_r(t)$ $h_{out}(t)$
$H_{in}(\Omega)$ $H_t(\Omega)$ $H_f(\Omega)$ $H_r(\Omega)$ $H_{out}(\Omega)$

Figure 1. Schematic for a Digital Fiber Optic Communications System

This paper proposes an approximation and realization method for this transfer function; we calculated the sensitivity loss value for a receiver created according to this approximation method; and we built a variable equalization circuit that can nearly realize the optimal transfer function. Test results and theoretical calculations were good and equivalent, which shows that the method and the variable equalization circuit that was built are both acceptable.

II. Construction of the Optimal Transfer Function and Its Circuit Structure

When discussing this problem we temporarily do not consider the effects of noise, that is, we assume the receiver has ideal noiseless conditions and just consider the problem from the view of eliminating intersymbol interference.

Given figure 1, the normalized transfer function for the optical receiver is $H_r(\Omega)$, thus the normalized spectrum function for the output signal of the optical receiver and its time-domain mode of representation are, respectively:

$$H_{out}(\Omega)=H_{in}(\Omega)H_r(\Omega) \qquad (1)$$

$$h_{out}(t)=h_{in}(t)*h_r(t) \qquad (2)$$

Here Ω is a normalized spectrum variable; * indicates convolution; while $h_{out}(t)=F^{-1}[H_{out}(\Omega)]$; $h_{in}(t)=F^{-1}[H_{in}(\Omega)]$;

$h_r(t)=F^{-1}[H_r(\Omega)]$; F^{-1} represents the Fourier inverse transform. If the response of $H_r(\Omega)$ to input signal $h_{in}(t)$ can satisfy the output signal $h_{out}(t)$:

$$h_{out}(t)=F^{-1}[H_{out}(\Omega)]=\begin{cases}1, & t=0\\ 0, & t=kT,\ k\neq 0\end{cases} \qquad (3)$$

then the output signal wave form for this receiver will have no intersymbol interference, and will thus have an optimal transfer function. In the equation, T is the symbol interval width, k=±1, ±2, . . .

From the data transmission principle[3], we know that if the phase angle function $\phi_{out}(\Omega)$ of $H_{out}(\Omega)$ is equal to 0, or $\phi_{out}(\Omega)=t_d\Omega$, here t_d is the time delay for the signal passing through the optical receiver, while its modulo function is as in the rising cosine roll-off function (bilateral) shown in the equation below:

$$|H_{out}(\Omega)|=\begin{cases}1, & 0<|\Omega|<(1-\beta)/2\\ 0.5[1-\sin(\pi|\Omega|/\beta-\pi/2\beta)], & (1-\beta)/2<|\Omega|<(1+\beta)/2\\ 0, & |\Omega|>(1+\beta)/2\end{cases} \quad (4)$$

and so equation (3) is satisfied. Here, β is the frequency domain roll-off factor. In fiber optic communications system β is often =1, and is called the full rising cosine roll-off, and therefore we can obtain from equation (4):

$$|H_{out}(\Omega)|=\begin{cases}\cos^2(\pi/2)\Omega, & 0<|\Omega|<1\\ 0, & |\Omega|>1\end{cases} \quad (5)$$

Then from equations (1) and (5) we can get the optimal transfer function for the optical receiver of:

$$H_r(\Omega)=H_{out}(\Omega)/H_{in}(\Omega)=H_{r1}(\Omega)H_{r2}(\Omega) \quad (6)$$

In the expression:

$$H_{r1}(\Omega)=1/H_{in}(\Omega) \quad (7)$$

$$H_{r2}(\Omega)=\left\{\begin{matrix}\cos^2(\pi/2)\Omega, & 0<|\Omega|<1\\ 0, & |\Omega|>1\end{matrix}\right\}e^{-j\Omega t_d} \quad (8)$$

Equation (6) shows that the optimal transfer function for the optical receiver is composed of the two cascade circuits shown in figure 2. In that, $H_{r1}(\Omega)$ represents the equalization of the input signal spectrum function, that is, $H_{in}(\Omega)H_{r1}(\Omega)=1$, and this signifies taking the spectrum equalization of the input signal as the spectrum of the unit pulse, the circuit structure for which is an equalizer; the circuit structure corresponding to $H_{r2}(\Omega)$ is a low-pass filter based on the full rising cosine roll-off and having linear dephasing, which forms the "unit pulse" obtained after equalization into an output wave form that satisfies equation (3). Therefore, as to the approximation and realization of the optimal transfer function for the optical receiver, it turns out to be the approximation and realization of $H_{r1}(\Omega)$ and $H_{r2}(\Omega)$.

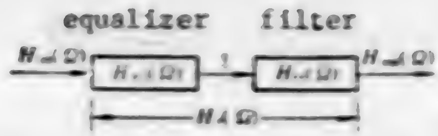


Figure 2. Circuit Structure for an Optical Receiver Optimal Transfer Function

III. The Approximation and Realization of the Equalization Function $H_{r1}(\Omega)$

The optical pulse $h_p(t)$ that the optical transmitter radiates into the fiber optic line has a certain rise time t_r and a fall time of t_f. For easy figuring, let $t_r=t_f$. Then, the time domain expression for this optical pulse may be written as[4,5]:

$$h_p(t)=\begin{cases} 1/\alpha_1 T, & 0<|t|/\alpha_1 T<(1-\gamma)/2 \\ \dfrac{0.5}{\alpha_1 T}\left[1-\sin\left(\dfrac{\pi|t|}{\alpha_1\gamma T}-\dfrac{\pi}{2\gamma}\right)\right], & \dfrac{1-\gamma}{2}<\dfrac{|t|}{\alpha_1 T}<\dfrac{1+\gamma}{2} \\ 0, & |t|/\alpha_1 T>(1+\gamma)/2 \end{cases} \qquad (9)$$

Equation (9) is a time domain rising cosine wave form, the diagram for which is shown in figure 3. In the equation above, γ is the time domain roll-off factor, and when γ is 0, $h_p(t)$ is a square wave; when γ is 1, $h_p(t)$ is a full rising cosine wave; α_1 is the pulse duration ratio, and half-life is $\alpha_1=0.5$; full duration is $\alpha_1=1$; T is the interval width.

Converting equation (9) to frequency domain, that is, $H_p(\Omega)=F[h_p(t)]$, and also considering the normalized optical power transfer function for long optic fiber lines more than some km in length, then we can use the following Gaussian approximation[6]:

$$H_f(\Omega)\approx\exp[-(2\pi\alpha_f\Omega)^2/2] \qquad (10)$$

where $\alpha_f=\sigma_f/T$, σ_f is the RMS width of the fiber optic line impulse excitation response, and it characterizes the size of the fiber optic line inter-modular dispersion. Therefore, the spectrum function for the optical receiver input end light pulse is[5]:

$$H_{in}(\Omega)=H_p(\Omega)H_f(\Omega)\approx\frac{\sin\alpha_1\pi\Omega}{\alpha_1\pi\Omega}\cdot\exp[-(\alpha_1\gamma\Omega)^2]\exp[-2(\pi\alpha_f\Omega)^2] \qquad (11)$$

The conditions for the establishment of the approximation expression are

$$\alpha_1 \gamma \Omega \leq 0.75 \qquad (12)$$

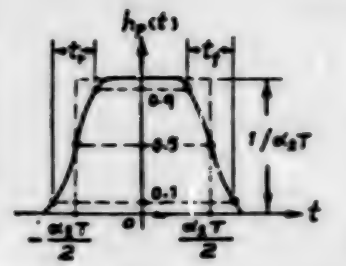


Figure 3. The Light Pulse Wave Form Upon Entering the Fiber Optic Line

From figure 3 and based on the definitions for rise and fall times: $t_r = t_f = |t_{0.9} - t_{0.1}|$, and we can then get from equation (9)

$$\alpha_1 \gamma = 1.693955 t_r f_b \qquad (13)$$

where $f_b = 1/T$, which is called the transmission code rate. Substituting (13) in (11), and after conversion, we get:

$$H_{1s}(\Omega) \approx \frac{\sin \alpha_1 \pi \Omega}{\alpha_1 \pi \Omega} \exp\{-2\pi^2[(0.38127 t_r f_b)^2 + \alpha_1^2]\Omega^2\} \qquad (14)$$

Then substituting (13) in (12) one gets the suitable range for (14):

$$0 < \Omega < 0.44/t_r f_b \qquad (15)$$

It can be seen from (15) that if we want to increase the suitable range of (14), we should reduce the leading edge rise time t_r of the transmitted light pulse.

In equation (14), the function diagram between $\sin \alpha_1\pi\Omega/\alpha_1\pi\Omega$ and Ω is shown as by the solid line in figure 4. When $\Omega=0$, the value of this function is 1 according to the (Luo-Bi-Ta[5012 1764 1044]); $\Omega=k/\alpha_1$, $k=1,2,\ldots$, which is the null point for this function; this function has negative values in the interval $(k/\alpha_1, (k+1)/\alpha_1)$; positive values in the interval $((k+1)/\alpha_1, (k+2)/\alpha_1)$. But $\sin \alpha_1\pi\Omega/\alpha_1\pi\Omega$ makes it difficult to realize the equalization circuit, and also complicates the mathematical processing connected with $H_{in}(\Omega)$. To avoid this kind of situation, this paper used one Gaussian function $\exp(-2\pi^2\alpha_p^2\Omega^2$ to approximate $\sin \alpha_1\pi\Omega/\alpha_1\pi\Omega$. Obviously, when $\Omega=\Omega_1=0$, $\exp(-2\pi^2\alpha_p^2\Omega_1^2) = \sin \alpha_1\pi\Omega_1/\alpha_1\pi\Omega_1 = 1$;

if we then let $\Omega=\Omega_2$, we can allow the establishment of the following expression

$$\exp(-2\pi^2\alpha_f^2\Omega_2^2)=\sin\alpha_1\pi\Omega_2/\alpha_1\pi\Omega_2=0.5 \quad (16)$$

Using the trial method one can obtain Ω_2 established in equation (16) to be:

$$\Omega_2=0.603/\alpha_1 \quad (17)$$

Substituting this Ω_2 into equation (16), we obtain:

$$\alpha_f=\sqrt{-0.5\ln 0.5}/\pi\Omega_2 \approx 0.310764\alpha_1 \quad (18)$$

Then, the Gaussian approximation for the function sin $\alpha_1\pi\Omega/\alpha_1\pi\Omega$ is then determined, the graph shown by the dotted line in figure 4. This shows that as an engineering approximation, the approximation adopted in this paper is appropriate. With this, equation (14) becomes:

$$H_{in}(\Omega)\approx\exp(-2\pi^2\alpha^2\Omega^2) \quad (19)$$

That is, the input light pulse of the receiver is approximated to a Gaussian light pulse. In equation (19):

$$\alpha^2=(0.38127t_r f_b)^2+\alpha_1^2+\alpha_f^2, \quad (20)$$

where: $\alpha_f=0.1874/\Omega_{-3dB\ optic}$, $\Omega_{-3dB\ optic}=f_{-3dB\ optic}/f_b$; $f_{-3dB\ optic}$ is the -3dB optic bandwidth for the overall length of the fiber optic line, which can be obtained either through calculation or trial; t_r can be had from actual testing.

Therefore, the equalizer transfer function obtained from equation (19) is:

$$H_{e}(\Omega)=1/H_{in}(\Omega)=\exp(2\pi^2\alpha^2\Omega^2),\ \Omega\leq 1, \quad (21)$$

We know from equations (6) and (8) that when $\Omega \geq 1$, $H_{r2}(\Omega)=0$, so equation (21) is all right as long as it is realized within the frequency band where $\Omega \leq 1$. Equation (21) can be implemented with the fixed impedence bridge T network or the feedback amplifier circuit, with which everyone is familiar, so we will not discuss it here.

IV. Approximation and Realization of the Filter Function $H_{r2}(\Omega)$

As for the linear phase shift and the full rising cosine roll-off low pass filter indicated in equation (8), if we directly use a rational function for approximation that can satisfy the network and realize the conditions, even if it is a rough approximation, the circuit structure that will be realized will be amazingly large, which is not an acceptable engineering fact.

What we used in this paper: we first used a Gaussian function $e^{-a\Omega^2}$ to approximate the modulo function $|H_{r2}(\Omega)|$, consequently obtaining:

$$H_{r2}(\Omega) \approx e^{-a\Omega^2} e^{-j t_d \Omega} \qquad (22)$$

Then we used a relatively low order Gaussian filter or Thomson filter to approximate and realize equation (22), in this way greatly simplifying the circuit structure that is realized. The method for checking whether the approximation method of this paper is satisfactory was to calculate the size of the receiver sensitivity loss created by it.

We know from equation (8) that $|H_{r2}(\Omega)|$ is the paired function of frequency Ω, and the function graph is asymmetrical with regard to points (0.5,0.5); also, when $\Omega=0$, $|H_{r2}(0)|=1$; when $\Omega \geq 1$, $|H_{r2}(\Omega)|=0$. Based on the asymmetrical conditions discussed above, let

$$e^{-a(0.5)^2} = \cos^2(\pi/4) = 0.5 \qquad (23)$$

From this solve for a and substitute in equation (22), at which time you get the Gaussian approximation of $H_{r2}(\Omega)$ to be:

$$H_{r2}(\Omega) \approx e^{-2.77259\Omega^2} e^{-j t_d \Omega} \qquad (24)$$

Figure 5 graphs the condition of approximation of $|H_{r2}(\Omega)|$ for $e^{-2.77259\Omega^2}$ in equation (8).

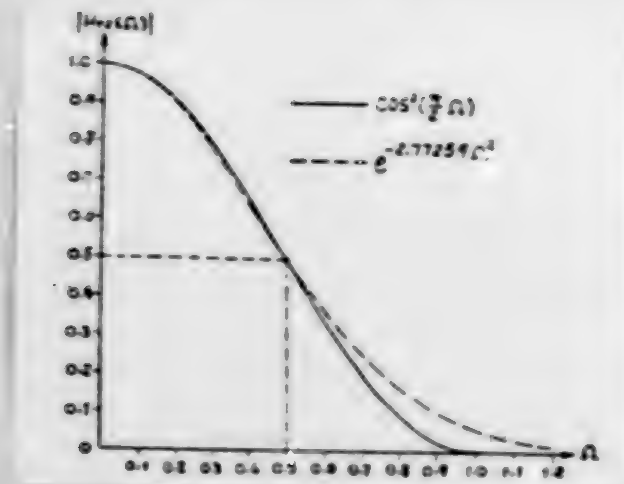


Figure 5. The Approximation of exp $(-2.77259\Omega^2)$ for $H_{r2}(\Omega)$

Equation (24) represents a low-pass filter where the amplitude frequency characteristic takes on a Gaussian form and the phase frequency assumes linearity. Network theory points out[7]: for the minimum phase network assuming a linear phase frequency characteristic within a sufficiently wide range, its amplitude frequency characteristic in the low frequency zone approximates the Gaussian function $e^{-a\Omega^2}$; if the Gaussian amplitude characteristic is approximated with the minimum phase function in the vicinity of zero frequency, then its phase characteristic in the low frequency zone will have approximate linearity. This then tells us that when using the minimum phase network to realize equation (24), we cannot at the same time achieve excellent amplitude and phase characteristics, and of the two we can only choose one. It is as the second section of this paper relates, that the linearity of the phase frequency characteristic is more important, as the amplitude characteristic needs only to be an approximation of the Gaussian function $e^{-a\Omega^2}$.

We know from equation (24) that the phase frequency characteristic that needs to be realized is $\phi_{r2}(\Omega)=t_d\Omega$. Then, the time delay characteristic that needs to be realized is $\tau(\Omega)=d\phi_{r2}(\Omega)/d\Omega=t_d$=constant. Therefore, we can use the smoothest time delay mode transfer function to approximate equation (24), as well as use it to synthesize the corresponding filter. Because the smoothest time delay mode transfer function is as proposed by Thomson, therefore this filter is called the Thomson filter; also, because this transfer function is related to the Bessel polynomial, this filter is also called the Bessel filter; in addition to this, some people call it the Gauss filter, because the amplitude frequency characteristic of this filter approximates the Gaussian function $e^{-a\Omega^2}$; we have selected this name, although it is not completely appropriate.

The expression for the smoothest time delay transfer function is:[8]

$$H(s)=\frac{b_0}{b_0+b_1s+\cdots+b_ns^n} \qquad (25)$$

in which

$$b_k=\frac{(2n-k)!}{2^{n-k}k!(n-k)!} \qquad (26)$$

where s is the complex frequency rate, n is the order of the denominator polynomial, k=0,1,2,...n.

Using the method by which the LC four-terminal network is integrated according to the working transmission function, from equation (25) we obtain the circuit structure for the n order Gaussian filter and the normalized component numerical value. For example, when n=5, from equations (25) and (26) we get:

$$H(s)=\frac{945}{945+945s+420s^2+105s^3+15s^4+s^5} \qquad (27)$$

Inserting $s=j\Omega'$ into the above equation we get the modular square number $|H(j\Omega')|^2$. Then we take $G(\Omega')=10\lg|H(j\Omega')|^2$(dB), normalize the -3dB point, and thus get the amplitude frequency characteristic for the 5th order Gaussian filter of:

$$\begin{aligned}G_5(\Omega')=-10\lg[&1+0.65071(\Omega')^2+0.241926(\Omega')^4\\&+0.070003(\Omega')^6+0.0197574(\Omega')^8\\&+7.71417\times10^{-3}(\Omega')^{10}](\mathrm{dB})\end{aligned} \qquad (28)$$

The circuit structure for the 5th order Gaussian filter and the normalized component value integrated from equation (27) are shown in figure 6. The actual component value for the circuit is: multiply the normalized values for capacitance and inductance by C_0 and L_0, respectively. Here:

$$C_0=1/2\pi R_0f_{-3dB}, \qquad L_0=R_0/2\pi f_{-3dB} \qquad (29)$$

where R_0 is the load resistance of the filter heading joint, and f_{-3dB} is the filter's -3dB bandwidth frequency.

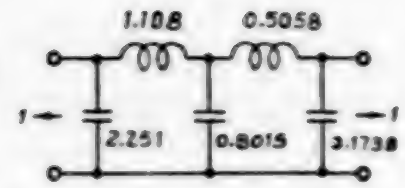


Figure 6. The Structure of a 5th Order Gaussian Filter and its Normalized Component Values

If we take the modular square from equation (24), rewriting it as

$$G_{r2}(\Omega) = 10 \lg |H_{r2}(\Omega)|^2 = 20 \lg e^{\ldots} \text{(dB)} \qquad (30)$$

we then get the Gaussian filter amplitude frequency characteristic that we need.

From equations (30) and (28) respectively, we calculate $G_{r2}(\Omega)$ and $G_5(k\Omega')$, then graph them in the same coordinate system, we can then check the size of the implementation error. Figure 7 shows the conditions of approximation for the amplitude frequency characteristics $G_5(k\Omega')$ and $G_9(k\Omega')$ of 5th and 9th order Gaussian filters to the amplitude characteristic $G_{r2}(\Omega)$ that we need to realize. It can be seen from the figure that if we want a low error rate, then we ought to use a higher order Gaussian filter; but the order value equals the component value, and so we ought to use the lowest order possible. We will see below that for practical applications a 5th order is sufficient.

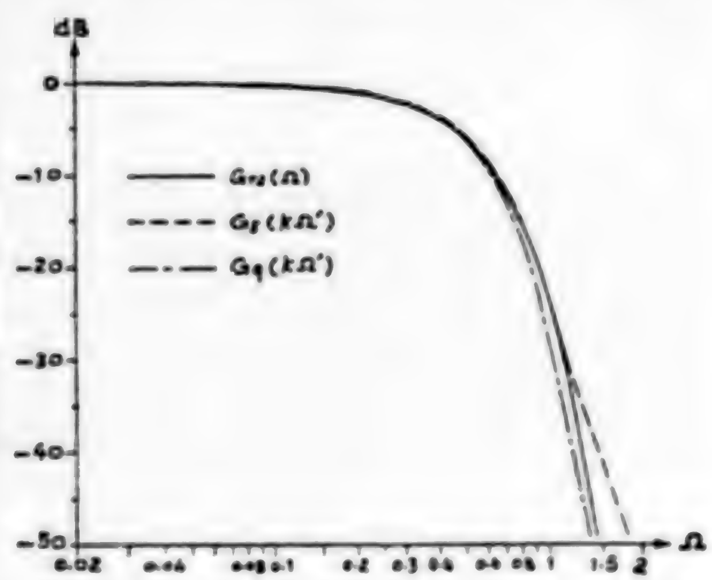


Figure 7. Approximation Conditions for 5th and 9th Order Gaussian Filters to the Gaussian Filter Required for Implementation

What we have shown here is that the $\Omega=f/f_b$ of equation (30) is the normalization of f_b, while the $\Omega=f/f_{-3dB}$ of equation (28) is the normalization of f_{-3dB}. When $\Omega=0.5$, $G_{r2}(\Omega)=-6dB$, while $G_5(\Omega')=-6dB$ and when $G_9(\Omega')=-6dB$, then $\Omega'\simeq1.37$. The two differ by $k=\Omega/\Omega'=0.5/1.37=0.365$ times, that is, $\Omega=k\Omega'=0.365\ \Omega'$. Therefore, when we graph $G_5(\Omega')$, $G_9(\Omega')$, and $G_{r2}(\Omega)$ on the same coordinate system, they ought to become $G_5(k\Omega')$, and $G_9(k\Omega')$. But when calculating the actual component values of a 5th order Gaussian filter, we should allow $f_{-3dB}=kf_b$.

V. The Approximate Realization of an Optical Receiver Optimum Transfer Function in a Small Dispersion System

From equations (6), (21), and (24) we can obtain the approximate expression for realizing an optical receiver optimal transfer function, which is:

$$\begin{aligned} H_*(\Omega) &= \exp[-c(1-2\pi^2\alpha^2/a)\Omega^2]\exp(-jt_d\Omega) \\ &= \exp[-2.77259(1-7.11941\alpha^2)\Omega^2]\exp(-jt_d\Omega) \end{aligned} \qquad (31)$$

We can see from the equation that when $(1-7.1194\alpha^2)>0$, equation (31) can be realized using a 5th order Gaussian filter, and it is not necessary to install another equalizer. From equation (31) it is easy to derive the relation between the normalized -3dB bandwidth frequency Ω_{-3dB} for the Gaussian filter we need to realize and α:

$$\Omega_{-3dB}=f_{-3dB}/f_b=0.3536/\sqrt{1-7.11941\alpha^2} \qquad (32)$$

Substituting $f_{-3dB}=\Omega_{-3dB}f_b$ into equation (29), and also given the value of R_0, we can calculate the component numerical value of the 5th order Gaussian filter of the approximately realized equation (31). The relation between Ω_{-3dB} calculated from equation (32) and α is shown in figure 8. We can see from that figure that when α is greater than 0.35, Ω_{-3dB} dramatically increases, which means that the noise power mean square value at the receiver output end also abruptly increases, consequently causing an abrupt drop in receiver sensitivity. Therefore, adequate values for α are $\alpha<0.35$. In this paper we have defined fiber optic communications systems where $\alpha<0.35$ to be small dispersion systems.

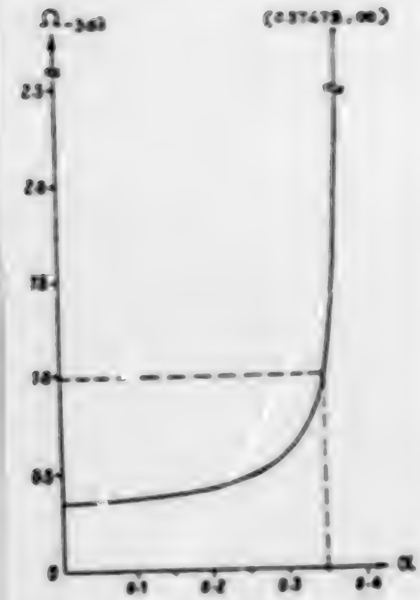


Figure 8. The Relation Between Ω_{-3dB} and α

VI. The Approximate Realization of an Optical Receiver Transform Function in Large Dispersion Systems

This paper defines fiber optic communication systems where $\alpha>0.35$ to be large dispersion systems. For this kind of system we can break α into the two parts of α_1 and α_2, as well as let $\alpha_2<0.35$, that is,

$$\alpha^2=\alpha_1^2+\alpha_2^2 \qquad (33)$$

Substituting this expression in equation (31) we get

$$H_r(\Omega)=H_{r1}(\Omega)H_{r2}(\Omega) \qquad (34)$$

in which

$$H_{r1}(\Omega)=\exp(2\pi^2\alpha_1^2\Omega^2) \qquad (35)$$

$$H_{r2}(\Omega)=\exp[-2.77259(1-7.11041\alpha_2^2)\Omega^2]e^{-jt_0\Omega} \qquad (36)$$

Equation (36) uses a 5th order Gaussian filter for an approximate realization, and its -3dB bandwidth frequency is calculated according to equation (32). Equation (35) is an augmented function of Ω^2, and to keep it from affecting the Gaussian roll-off determined by equation (36), we can structure $H_{ra}(\Omega)$ this way, allowing

$$H_{ra}(\Omega)=\begin{cases}\exp(2\pi^2\alpha_1^2\Omega^2), & \Omega<1\\ \exp[2\pi^2\alpha_1^2(2-\Omega)^2], & \Omega>1\end{cases} \qquad (37)$$

Afterwards, we can realize equation (37) with a fixed impedence bridge T network or a feedback circuit.

VII. Loss in Optical Receiver Sensitivity Brought About by Gaussian Approximation

This section deals only with a calculation method for the loss in receiver sensitivity as caused by Gaussian approximation of the optimal transfer function, and actual examples will be given at the end.

Among chief factors affecting receiver sensitivity, one is noise and another is the receiver transfer function $H_r(\Omega)$. The latter generates its effects through the following five parameters.

$$\begin{aligned}
I_1 &= \int_{-\infty}^{\infty} H_{in}(\Omega)[H_r(\Omega) * H_r(\Omega)]d\Omega\\
\Sigma_1 &= \sum_{k=-\infty}^{\infty} H_{in}(k)[H_r(k) * H_r(k)]\\
I_2 &= \int_{-\infty}^{\infty} |H_r(\Omega)|^2 d\Omega\\
I_3 &= \int_{-\infty}^{\infty} |H_r(\Omega)|^2 \Omega^2 d\Omega\\
I_4 &= \Sigma_1 - I_1
\end{aligned} \qquad (38)$$

We know from equation (19) that the normalized frequency spectrum function for the optical receiver input optical pulse signal is $H_{in}(\Omega)=\exp(-2\pi^2\alpha^2\Omega^2)$; to simplify calculation, let the time delay t_d of the optical receiver be equal to 0; therefore, from equations (6) through (8) and (31) we get an optical transfer function and its Gaussian approximation, respectively, to be

$$H_r(\Omega)=\exp(2\pi^2\alpha^2\Omega^2)\cos^2(0.5\pi\Omega) \qquad (39)$$

$$H_r(\Omega)=\exp[-2.77250(1-7.11041\alpha^2)\Omega^2] \qquad (40)$$

Substituting equations (19) and (39) into equation (38) we calculate I_1, Σ_1, I_2, I_3, I_5, substitute for them in the formula for calculating receiver sensitivity, and let the calculated sensitivity be S_1; in the same way substitute equations (19) and (40) for equation (38), and let the calculated sensitivity be S_2; then the loss in optical receiver sensitivity brought about by the Gaussian approximation is

$$\Delta S = S_2 - S_1 \quad (\mathrm{dB}) \qquad (41)$$

For large dispersion systems where $\alpha>0.35$, the ΔS calculation is the same, but equation (40) must be changed to the following expression:

$$H_r(\Omega) = H_{ra}(\Omega) H_{rs}(\Omega) / e^{-\cdots} \qquad (40a)$$

Also, handle the $H_{ra}(\Omega)$ within according to equation (37).

VIII. Implementation of a Variable Equalization Circuit in an Optical Receiver

In engineering applications we often need variable equalization circuits for optical receivers that are simple in structure and easy to adjust, to suit fiber optic lines of different bandwidths. One can see from equation (20) that this requires that between the variable components of the variable equalization circuit and the relative RMS bandwidth α of the optical pulse input to the optical receiver there is a certain correspondence relation. The variable equalization circuit that this writer built and which has this kind of correspondence relation is shown in figure 9. The voltage transfer function for this circuit is:

$$T(s) = -V_o(s)/V_i(s) = -r/(s^2+2\zeta s+1) \qquad (42)$$

where $r=R/R_e$, a gain constant; s is the normalized complex frequency;

$$\zeta = \frac{1}{2} R \sqrt{\frac{C}{L}}, \text{ is the damping factor.} \qquad (43)$$

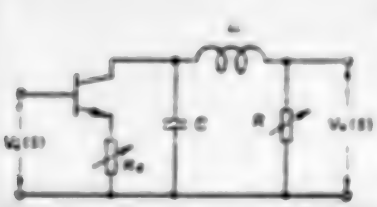


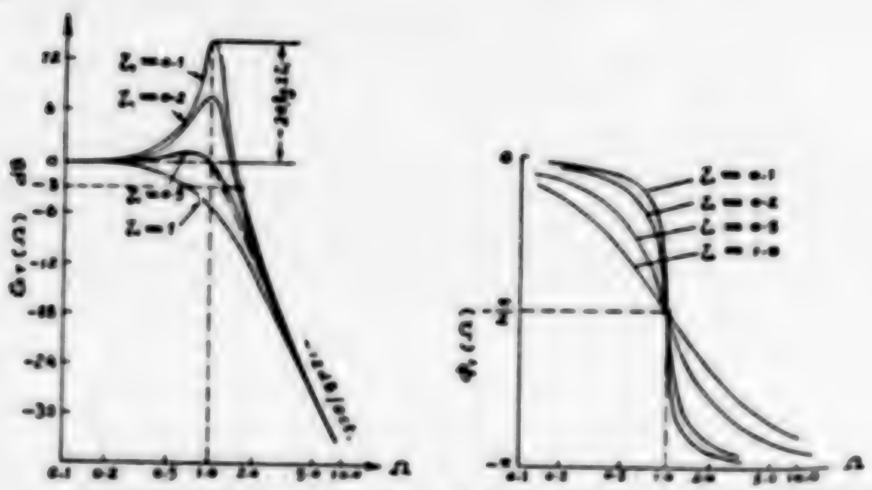
Figure 9. Structure of a Variable Equalization Circuit

Let $s=j\Omega$, $r=1$, substitute for equation (42), and after transformation the normalized amplitude frequency characteristic and phase frequency characteristic obtained for this circuit are:

$$G_T(\Omega)=-10\lg[(1-\Omega^2)^2+(2\zeta\Omega)^2]\ \mathrm{dB} \tag{44}$$

$$\phi_T(\Omega)=-\mathrm{tg}^{-1}[2\zeta\Omega/(1-\Omega^2)] \tag{45}$$

The function graphs for equations (44) and (45) are shown in figure 10.



(a) amplitude frequency characteristics (b) phase frequency characteristics

Figure 10. Frequency Characteristics of Variable Equalization Circuits

One can see that the -3dB bandwidth of the amplitude frequency for this circuit increases as ζ decreases; within the range of $0.5\leq\zeta\leq1$, the phase frequency characteristic $\phi_T(\Omega)$ of this circuit, relative to the straight line through the two points (0,0) and $(1,-\pi/2)$, assumes an equivalent fluctuation of a smaller deviation. Therefore, we can see equation (45) as being in equation (31), an approximation of $-\phi_r(\Omega)=-t_d\Omega$; then write the amplitude frequency characteristic of equation (31) as:

$$\begin{aligned}G_r(\Omega)&=10\lg|H_r(\Omega)|^2\\&=20\lg\exp[-2.77259(1-7.11941\alpha^2)\Omega^2](\mathrm{dB})\end{aligned} \tag{46}$$

Finally, approximate equation (46) with equation (44), and if the approximation deviation $\Delta(\Omega)=|G_T(\Omega)-G_r(\Omega)|$ can satisfy the needs of actual use, then

the variable equalization circuit shown in figure 9 can be used to realize approximately a circuit structure for an optical receiver optimum transfer function in a small dispersion system. As shown in conditions of actual use in both the Institute's 24.6 km fiber optic line and the Wuhan operational 13.6 km fiber optic communications experimental segment, this circuit achieves the predicted results.

One can see from equations (44) and (46) that when $\Omega=0$, $G_T(0)=G_r(0)=0$; then, when letting $\Omega=\Omega_{-3dB}$, and $G_T(\Omega_{-3dB})=G_r(\Omega_{-3dB})=-3dB$, then from equations (32) and (44) we can solve for the corresponding relation between α and ζ:

$$\Omega=\Omega_{-3dB}, G_T(\Omega_{-3dB})=G_r(\Omega_{-3dB})=-3dB \quad (47)$$

We know from equation (43) that there is a linear correspondence relation between ζ and R, and therefore in small dispersion systems, when fiber optic bandwidths are different, that is, when α is different, in order to allow the transfer function of the optical receiver to approach the optimum, one only needs to adjust in the field the variable resistor in figure 10; if it is necessary to still do a little gain balancing, one just needs to readjust the variable resistor R_e.

Multiplying equation (42) by $(1+s/2\zeta)/(1+s/2\zeta)$, then expand the continued fraction, one can get the component calculation formula for the equalization circuit in figure 9:

$$\left.\begin{aligned} &L=rL_0/2\zeta; \quad L_0=R_e/2\pi f_e \\ &C=2C_0\zeta/r; \quad C_0=1/2\pi f_e R_e \\ &R=2\zeta\sqrt{L/C} \end{aligned}\right\} \quad (48)$$

where ζ is calculated according to equations (47) and (20); r and R_e can be determined by the designer according to component value reasonableness and the gain produced by the needed circuit.

The equalization function $H_{ra}(\Omega)$ for the large dispersion system shown in equation (37) can also be realized with the figure 9 circuit. Equation (39) can be rewritten to

$$G_{ra}(\Omega)\begin{cases} =20\lg\exp(2\pi^2\alpha_1^2\Omega^2), & \Omega\leq 1, \text{ (dB)} \\ \leq 20\lg\exp[2\pi^2\alpha_1^2(2-\Omega)^2], & \Omega>1, \text{ (dB)} \end{cases} \quad (49)$$

Using the approximation (49) of equation (44), when Ω is 0, $G_T(0)=G_{ra}(0)=0$; when letting $\Omega=1$, $G_T(1)=G_{ra}(1)$; from this we obtain the relation of ζ and α_1 to be

$$\zeta=0.5\exp(-2\pi^2\alpha_1^2) \quad (50)$$

where α_1 is calculated according to equation (33); we already know ζ, so we can calculate the component values according to equation (48). The approximation discussed above only needs to be done in the range where $0 \leq \Omega \leq 1$; when $\Omega < 1$, there is no need for the approximation deviation $\Delta\Omega$. For example, if given that $\alpha = 0.45$; let $\alpha_2 = 0.35$, then from equation (33) we obtain $\alpha_1^2 = 0.08$; from equation (50) we get $\zeta = 0.103$; then using equations (44) and (49) we can calculate the maximum deviation for the approximation discussed above to be

$$\Delta_{max}(\Omega) = \max_{0 \leq \Omega \leq 1} \left| G_T(\Omega) - G_{..}(\Omega) \right| < 1.3\,\mathrm{dB} \qquad (50a)$$

As an engineering approximation, we may consider that this is a suitable approximation. When fiber optic line bandwidths differ, and when α_1 is consequently different, then by adjusting the variable resistor R we can achieve the desired equalization characteristic.

IX. Design Examples and Test Restuls

Here we provide the optical receiver as designed by the method in this paper and its test results. This receiver has already been in operation in the Institute's fiber optic communication system with a junction interval of 24.6 km, wavelength of 1.3μm, and code speed of 34 Mb/s, as well as on the Wuhan municipal telephone system 1.36 km optical cable communications experimental segment, with wavelengths and code speed, respectively, of 1.3μm and 34 Mb/s, both with good results.

1. A Design Overview and Actual Test Results

This optical receiver uses a PIN-FET stepped impedence amplifier as a front-end circuit, its thermal noise factor z and sensitivity S being calculated according to the following equations:

$$z = \frac{1}{e}\left[\left(I_t + \frac{2k\theta}{eR_F}\right)\frac{I_2}{f_b} + \frac{8\pi^2 C_t^2 k\theta\Gamma}{eg_m} I_3 f_b\right] \qquad (51)$$

$$S = 10\,\lg \frac{6ef_b}{R \times 10^{-3}}\sqrt{z} \qquad (\mathrm{dBm}) \qquad (52)$$

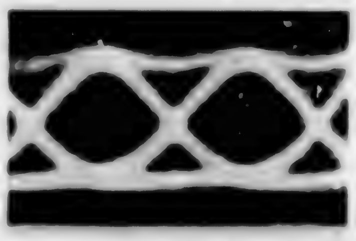
where: I_t is the total leaked current for the PIN and FET, R_F is the feedback resistance for the stepped impedence amplifier, g_m is the FET transconductance, and γ is the channel noise factor; C_t is the overall input capacitance (of the PIN, FET, and lead wires), f_b is the transmission rate, θ is the absolute temperature, R is the responsiveness of the PIN photodiode, k is the Boltzmann constant, e is the electronic charge, and I_2 and I_3 are calculated according to equation (38).

With actual testing, rise time t_r=2 ns for the transmitted optical pulse; the bandwidth $f_{-3dB\ optic}$ for the 24.6 km fiber optic line =29.7 MHz; the pulse duration ratio α_1 for the transmitted optical pulse = 0.5; this fiber optics communications system uses a 3B4B line code mode, thus f_b=45.824 Mb/s. Substituting this data for equations (18) and (20) we get α=0.33, and substituting for α in equation (31) we get:

$$|H_{\cdot}(\Omega)| = e^{-0.[illegible]\Omega^2} \qquad (53)$$

Substituting equation (53) for equation (38) we get:

I_2=1.58787, I_3=0.637188. We substitute this into equation (51); then we substitute I_t=0.15μA, R_F=52kΩ, g_m=40mS, C_t=5.24pF, θ=300°K, R=0.7A/W, Γ=1.15 (this receiver uses GaAs FETs), f_b=45.824 Mb/s into equations (51) and (52), from which we can then calculate that the optical receiver sensitivity S_2 under Gaussian approximation of the optimal transfer function is -43.35 dBm; when this receiver has an error rate less than 10^{-9}, measured sensitivity S_m in the 24.6 km transmission system equals -43 dBm, very close to the theoretical calculation of S_2. Figure 11 is an optigraph of the receiver output terminal when the measured sensitivity is at -43 dBm.



vertical: 0.8V/div.
horizontal: [illegible]

Figure 11. Optigraph of the Receiver Output Terminal

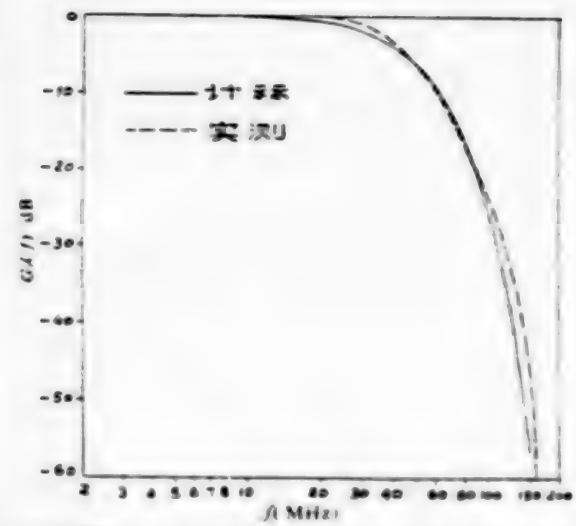
This receiver uses the circuit in figure 9 to nearly realize the optimal transfer function of α=0.33. Taking α=0.35, r=3, and R_e=82Ω, then we get the component values for equations (47) and (48) for this circuit of L=0.597μH, C=20pF, and R=246Ω.

Taking $0.16 \leq \alpha \leq 0.35$ as the equalization range for the equalization circuit, then from equations (47) and (48) we can calculate the range of resistance value change for the R to which it corresponds as being $498\Omega \geq R \geq 246\Omega$; therefore, using a 510Ω variable resistor input circuit we can realize the equalization circuit described above. From equation (32) and with $f_{-3dB} = \Omega_{-3dB} f_b$, we can calculate the range of change for the variable equalization corresponding to $0.16 \leq \alpha \leq 0.35$ to be $17.9\ \text{MHz} \leq f_{-3dB} \leq 45.3\ \text{MHz}$; after turning the variable resistor R, the measured value for this circuit is $17\ \text{MHz} \leq f_{-3dBm} \leq 46\ \text{MHz}$.

We can obtain from equation (53) the fact that we need the amplitude frequency characteristic realized from this receiver to be

$$G_r(f) = 20\lg\exp(-0.623f^2) \quad \text{dB} \qquad (54)$$

where $f = \Omega f_b$. According to this formula, the normalized amplitude frequency characteristic as graphed is shown as the solid line in figure 12; the dotted line in the figure shows: by turning R in the variable equalization circuit, the measured normalized amplitude characteristic for this receiver is very close to the calculated value $G_r(f)$.



(55)

——— estimate
----- actual measurement

Figure 12. A Comparison of the Normalized Amplitude Characteristic for the Receiver Intended to be Implemented to the Measured Amplitude Characteristic

Figure 13 is an optigraph obtained after turning R in the variable resistor circuit when this receiver was operating at the Wuhan Municipality 13.6 km optic cable communications experimental segment.

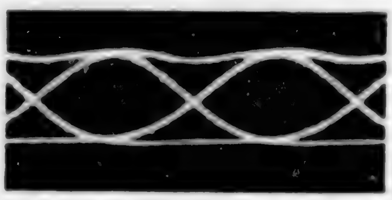


Figure 13.

At the same time we point out that $\alpha=0.16$ is when $t_r=2$ ns, $f_b=45.824$ Mb/s, $\alpha_1=0.5$, $\alpha_f=0$, calculated according to equations (18) and (20). $\alpha_f=0$ signifies that the length of the fiber optic line is zero, that is, that receiver and transmitter are directly connected.

2. Calculating the Value of Optical Receiver Sensitivity Loss as Brought About by Gaussian Approximation

The modulo function of the receiver optimal transfer function derived from equations (6) through (8) and (19) is

$$|H_r(\Omega)| = \exp(2\pi^2\alpha^2\Omega^2)\cos^2(0.5\pi\Omega) \qquad (55)$$

Substituting equation (55) and $\alpha=0.33$ for equation (38) we get: $I_2=1.226284$, $I_3=0.192885$. Substituting I_2, I_3 for equation (51), I_1, R_F, g_m, C_t, R, γ, f_b, and θ still have the values when calculating S_2, and also, substituting for equations (51) and (52), whereupon we get below the optimal transfer function, $S_1=-44.77$ dBm, thus the value ΔS of the loss in optical receiver sensitivity as brought about by Gaussian approximation equals $S_2-S_1=-43.35+44.77=1.42$dBm. This value is not considered great, but when transformed is a largely simplified receiver circuit. (In figure 13, vertical axis: 0.5 V/div, horizontal axis: 5 ns/div)

X. Conclusions

This paper does not consider the effects of noise, and is just an optimization in regard to the significance of intersymbol interference. In fact, the effects of noise cannot be eliminated. And, the bit error rate is affected by the receiver equivalent noise bandwidth and intersymbol interference; to reduce intersymbol interference requires increasing the equivalent noise bandwidth; the converse is also true. Therefore, there is an optimal compromise between the two. We can see from equation (32) that reducing equivalent noise bandwidth, which means appropriately reducing the value of α in the expression to obtain the optimal compromise. If the variable equalization circuit in this paper is used, then the optimal compromise discussed above can be easily obtained just by turning the variable resistor R in the circuit.

We can see from equations (18) and (20) that if transmitted optical power is sufficient, then the rise time t_r for the optical pulse is sufficiently small, then we can choose the pulse duration ratio α_1 for the optical pulse between 0 and 1, and by reducing α can then consequently reduce intersymbol interference.

We should explain at this time that in large dispersion systems to obtain excellent optical receiver performance, one can use decision feedback equalization[10] and partial response optical fiber communications systems[11].

The author plans to report on work in this aspect in another paper.

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12586
CSO: 5500/4151

PEOPLE'S REPUBLIC OF KAMPUCHEA

PHNOM PENH TELEVISION RESUMES BROADCASTING

OW031345 Tokyo NHK Television Network in Japanese 1000 GMT 3 Sep 85

[Text] In Phnom Penh, capital of Cambodia where a conflict has been going on, full-scale television broadcasting has resumed for the first time in 10 years.

[Begin recording of a report filed by Bangkok correspondent Toshiyuki Sato] It was about 1 year ago that Television Cambodia Broadcasting Station [Telebi Kambojiya Hosokyoku] in Phom Penh began test broadcasting once a week. Following this, it recently began full-scale broadcasts three times a week from 1830 to 2100 in the evening. The station is staffed by 70 persons.

In the past 10 years the government changed hands in rapid succession--from the Lon Nol regime to the Pol Pot government and then to the present Heng Samrin administration. In the political changes all the transmission equipment was completely destroyed, and all the equipment the station now has is brand new. Conspicuous among them are Japanese-made cameras and monitor TV sets.

Taking charge of program production and technical guidance are staff members dispatched from a local broadcasting station in Vientam, and the director is a Vietnamese national. The programs consist of news and documentaries beginning at 1830, followed by entertainment programs. However, music, cartoons, and other programs are mostly those produced in the Soviet Union and Vietnam.

Since the price of a receiving set is so high as to be equivalent to a 1 and 1/2 years' pay of an average government official, it seems that relatives and neighbors all contribute to purchases a TV set for joint viewing.

There are no other broadcasting stations in Cambodia than Television Cambodia. Hence, the broadcast can be viewed in Phom Penh city only. It goes without saying that resolution of the internal conflict is prerequisite to the arrival of a day when television can be viewed all over Cambodia. [end recording]

CSO: 5500/4304

PHILIPPINES

ASEAN JOURNALISTS AGREE TO SET UP NEWS AGENCY

Manila BULLETIN TODAY in English 15 Sep 85 p 43

[Text]

PENANG, Malaysia (PNA) — ASEAN senior journalists have just ended here their three-day meeting, but begun what observers described as a renewed attempt to pare down media's dependence on foreign wire services.

They agreed to take steps to set up an ASEAN News Agency to professionalize the editorial capability of the region's journalists that will match, if not surpass, that of the transnationals.

The move was initiated by Philippines News Agency (PNA) General Manager Jose L. Pavia in the wake of continued domination of the foreign wire agencies over the dissemination of information in the region.

He said that although it is unfair to compare the ASEAN news agencies with those of the Western countries, "it is a situation that we have no choice but to meet head-on."

"If the ASEAN news exchange is to be compared to the transnationals as is being done now — and that is unfair at this point in time of its existence — then the exchange better go about being the professional news agency that its end-users perceived it to be in the best traditions of the world's professional news agencies," he said.

"And that means being excellent, accurate, fast, and reliable, Pavia added.

Some 100 journalists attending the three-day meeting here came not only from the ASEAN wire services, but also from newspapers, radio, television, and other media outfits in the region.

One of those who immediately endorsed the PNA proposals was Dr. Munir Majid, group editor of Straits Times of Malaysia.

"It is a move in the right direction," he said.

It would improve the existing loose arrangement of the ANEX and the quality and speed of copies, he said. "It would lead to better coverage of ASEAN events in the world."

Pavia, conference rapporteur-general, said the ASEAN news agency would be manned by a pool of trained and highly skilled journalists with regional expertise and perspective.

Their job, he said, is to plan, supervise, and coordinate the daily operations of the ANEX.

CSO: 5500/4305

PHILIPPINES

BRIEFS

JAPANESE AID TELECOMMUNICATIONS TRAINING--Japan's Nippon Electric Company is expanding a $1 million aid [as heard] to upgrade the training of telecommunications technicians in the Philippines. The money is being coursed through the Ministry of Transportation, which will then set up a scholarship fund at the University of the Philippines. The Japanese electric firm will put up a foundation in Manila to serve as the depository of the amount. [Text] [Quezon City Maharlika Broadcasting System in English 0400 GMT 4 Oct 85 HK]

CSO: 5500/4306

THAILAND

MINISTER ON PLANS TO UPGRADE TELECOMMUNICATIONS

BK090714 Bangkok Domestic Service in English 0000 GMT 8 Aug 85

["News in Perspective" feature]

[Text] The Mass Communications Organization of Thailand, or the MCOT, plans to set up a new company to provide teletext and other telecommunications services, including cable television. The new company, to be named Thai News Company, is part of MCOT's plan to expand its operations. Minister to the Prime Minister's Office Police Lieutenant Chan Manuthan said a working group, chaired by former supreme commander General Saiyut Koetphon, is currently working on the plan. According to Pol Lt Chan, the new company will be an independent organization separate from the MCOT, which will give the new setup more flexibility in directly supplying business news information via satellite and other means to business establishments. Under the plan, the state-owned MCOT will hold 25 to 30 percent of the equity in the new company. The Bangkok Entertainment Company, operator of Channel 3, might also take part in the new firm, with the remaining minority shares to be offered to private firms.

Pol Lt Chan says the Thai News Company will mainly concentrate on providing telecommunications services to local business establishments, including teletext, which is the latest and most advanced telecommunications system currently available in many leading financial cities. These teletext facilities will be installed by the Communications Authority of Thailand. Pol Lt Chan says this new telecommunications equipment will enable business establishments to receive firsthand information to help them in making rapid decisions in cases where circumstances require.

Apart from the teletext, the new company will also operate cable television program, which was earlier discussed by various interested parties. The minister says negotiations are underway with the CNN of the United States which operates Cable News Network to allow Thai news companies to act as its agent in providing a 24-hour cable news service, mainly dealing in worldwide financial reports via satellites. The project, if launched, is expected to essentially help the country upgrade its telecommunications system, particularly for the business community. Pol Lt Chan says first that negotiations are also underway with foreign news agencies to have Thai News

Company act as their middleman in supplying news to local firms. Also included in the plan is a move to have the new firm operate a radio station which would supply mainly business news to supplement the cable television service. The minister adds that the idea is to make the planned new company a first class business news information center for the local community.

CSO: 5500/4304

THAILAND

BRIEFS

SULI: NO SATELLITE NEEDED--Flying Officer Suli Mahasanthana has emphasized that at this time it is not necessary for Thailand to operate communications satellites but it would not be opposed to investment by the private sector in this field, according to Yotying Unawatthanasakun, an executive of the Bara Windsor Company, who accompanied (Jack Tennant), a U.S. communications satellite specialist, when he called on minister attached to the prime minister's office Suli. (Tennant), a Comsat general corporation specialist, explained details about operating a telecommunications systems. Minister Suli informed the visitor that at present the government has no need to own a satellite communications system but it is willing to allow the private sector from abroad to invest in the field. [Text] [Bangkok KHAO PHANIT in Thai 3 Aug 85 p 4 (tentative)]

STATION BEGINS TELETEXT SERVICE--From 1 October, the Mass Communications Authority will transmit information via teletext to your homes 4 hours every day free of charge. The information includes political, economic, financial, weather, and banking news; foreign exchange rates; and travel information. The transmitted information will be useful in carrying out daily life. In addition, foreign news received by teletype will be reported in Thai via teletext to enable viewers to know what is happening in the world every minute the teletext service will be transmitted on Channel 9 twice a day 0700-0900 [0000-0200 GMT] and 1330-1530 Monday through Friday. [Text] [Bangkok Domestic Television Service in Thai 1300 GMT 27 Sep 85]

CSO: 5500/4304

BULGARIA

DEPUTY MINISTER INTERVIEWED ON NEW RADIO, TELEVISION STATION

Sofia IMPULS in Bulgarian 27 Aug 85 pp 1,2

[Interview with Yanko Yanev, Deputy Minister of Communications, by Nina Encheva of the editorial staff of Impuls: "To the command of the party, with concrete actions", conducted on August 26, 1985, at a press conference in the Ministry of Communications on the occasion of the opening of the new radio television station "Sofia-Vitosha" on September 2.]

[Text] 2 September - video and sound signal from "Sofia-Vitosha" We talk with Yanko Yanev, Deputy Minister of Communications, about the advantages of the new station. What should we know at the outset?

The days can be counted to the trial run of a unique facility - the complex radio-television station "Sofia-Vitosha". More than 5 years have elapsed since its inception and now, on the eve of the Day of Liberation, the new tower is beginning to emit sound and video signals. It was due to start operating at the end of the year, but thanks to the efforts and selfless, round-the-clock work of officers at the Ministry of Communications, of Minister Pando Banchev himself, and of the builders, fitters and specialists, residents of Sofia and Pernik, a large part of these okrugs, and part of the Vrachan okrug will have a ten-times stronger television signal and a twenty-times stronger radio signal of much greater quality.

A member of the editorial staff met and talked with the Deputy Director of Communications, Yanko Yanev.

These days, I suppose that it is not only representatives of the press, radio and television who are constantly besieging you with questions. As we know, the successful 72-hour test provoked considerable public reaction. Many citizens called in with opinions and impressions and helped you to syntonize the transmitters more precisely. Nevertheless, what are the advantages of this facility? What will the citizens receive?

The new complex radio-television station "Sofia-Vitosha" really is a unique facility. With it, we shall guarantee high-quality signal emissions. I should like to emphasize that we have used world-class installation

technology. Moreover, the area served is repeatedly enlarged and is guaranteed an even distribution of the overhead. We were able to put the transmitters into operation ahead of time thanks to the great amount of work put in by everyone involved, either directly or indirectly, with KRTT. It is not enough to thank the people for their selfless work. The emission, ahead of schedule, on 2 September of this year (instead of at the end of the year) allows us to plan a gradual syntonization of television receivers and citizens' receiving sets, which will guarantee us a high-quality final result.

This takes us to the second question. What must the owners of radio and television sets do after 2 September to receive normal, quality video and sound signals from the new station? On which channels and which frequencies will the emissions be made?

We still have considerable work ahead of us. But once again I should like to point out that our work will be made easier by the fact that the transmitters will be put into operation simultaneously. This is what I have in mind. Emissions from the old television tower will continue for the second television program until 30 April 1986. In this way, we shall have 8 months to syntonize the receivers. This is a delicate, precise and strictly individual activity. From 2 September of this year, the first television program will be transmitted only by KRTT "Sofia-Vitosha" on channel 7, just as it has been up to now by the old tower. During these 8 months, the second television program will continue to be transmitted by the "Sofia" tower on channel 12, and by the new tower on channel 20 in decimeter range. As far as the radio programs "Horizon", "Khristo Botev", "Orpheus" and "Knowledge" are concerned, these will be emitted on ultrashort waves in stereo in the frequency range 66-77 megahertz, and "Horizon" will be emitted at 103 megahertz. I mention these technical data on purpose, because with the new station we shall be able to offer the citizens a high-quality video and radio signal. One more point: all things considered this is a three-in-one system -- a good studio, a good transmitter and a good receiver. We have also accomplished part of our plan to develop the networks for radio and television broadcasts of the capital's program for a worthy reception of the 13th Party Congress.

It is natural to have some finishing touches to add to this process. Some things do not depend on the Ministry of Communications. How will the work be coordinated from now on, and with which departments?

Of course, some problems will arise, but we are ready to solve them efficiently. We have had a series of discussions with representatives of Resprom, the State Construction Trust, of SD television and radio service stores and of the companies dealing with spare parts and new technology in the State Construction Trust wholesale system in Sofia. Concrete tasks for the next eight months were outlined at these meetings. We have an exact and realistic picture of the present state of the warehouse supply, of the potential of television service stores and of production at Resprom. From the balance sheet, it is clear that we have created a good organization and synchronization between the separate departments. This will ensure that we shall solve those problems that arise during the course of our work. In

addition, citizens can obtain more detailed information from the mass media and their television service stores.

And so, 2 September is knocking at our doors. What should we know? First and foremost is that antennae should be directed toward the new transmitter "Sofia-Vitosha". In addition, for television owners, the locally manufactured sets Sofia 11, 21, 22, 31, 81, 82 and 83, Tsarevitz, all models of the Resprom series and the following sets imported from the USSR: Temp, Yunost, Shilyalis, Rubin and Electron (which, according to the model number, bear the letter D or V) have built-in systems for receiving all programs and do not require additions for the decimeter range. In some cases, some additional regulation of the television receiver will be necessary for normal reception of the programs of the Bulgarian Television due to the high emission power of the new transmitter. The old models of television receivers such as Opera, Kristal, Pirin, Sofia-59, Osogovo, Murgash, Miziya, etc, the black and white sets produced in the USSR such as Elektron, Rubin, Temp and Yunost and the color sets Elektron 706 and Rubin 707, that are not suitable for reception of television programs on decimeter range, may be readjusted by radio and television specialists at the request of citizens.

And here the question of collective antennae arises. The problem is not new and is being worked on, but now the advantage of this kind of antenna is indisputable. Everything possible will be done to introduce it on a mass scale. This will not only have an esthetic effect (by removing the forest of antennae from the roofs) but will guarantee high-quality reception of the emitted signal.

One more thing that we should not forget. Since the power of the new transmitters, and hence the strength of the emission, is much stronger, it will be necessary to syntonize the receivers individually. To facilitate [the task of] our readers, we may add that they may find all the necessary appliances in the chain of stores dealing with spare parts and new technology, in radio and television service stores and in the specialized stores of the State Construction Trust, Resprom.

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Yesterday, 26 August, a press conference was held at the Ministry of Communications to discuss questions connected with the impending operation of the complex radio-television station "Sofia-Vitosha" on 2 September. The following participated in the discussion: Engineer Yanko Yanev, Deputy Minister of Communications, Purvan Purvanov, chief secretary at the ministry, specialists from the department, Kostadin Statelov, chief specialist in the State Construction Trust, Resprom, Georgi Khristov, head of the department of radio and television parts in the company dealing with spare parts and new technology in the wholesale department at the State Construction Trust, and Tancho Apostolov, director of SD television and radio services, Sofia. In his expose, Deputy Minister Yanko Yanev informed the journalists of what has been done up to this point and the imminent tasks of the ministry in connection with putting KRTT "Sofia-Vitosha" into operation.

The many questions put by representatives of the mass media were answered comprehensively and competently by specialists in the respective areas.

12907
CSO:5500/3034

ARGENTINA

FIRMS SUBMIT BIDS FOR DATA PROCESSING PACKAGES

Buenos Aires INFORME INDUSTRIAL in Spanish No 82 Jun 85 p 18

[Text] The envelopes containing public bids for allocation of industrial promotion packages in the data processing area, in the framework of the recommendations of the National Informatics Commission, were opened at a ceremony presided over by the secretary of industry.

The competitive bid announcement, made through Resolution No 44 of the Secretariat of Industry, which had aroused broad discussion in business circles at the time, involved offers for eight segments of informatics activity. The 57 bids, the majority of which were made by national capital companies, provide for an investment in excess of $100 million and the possibility of employing around 4,000 highly skilled technicians.

According to statements by officials in the area, the first estimates of the bids indicate several positive things:

- There are approximately three projects for each of the 25 packages of incentives bid on;

- The companies are generally made up of sound investors representative of national business, in many cases associated with leading multinational firms, which have found the government strategy of industrial development in the sector feasible and advantageous;

- The initial products would be of the last generation and, taking into account the mandatory need to proceed with a change in a definite period of time, it is guaranteed that the domestic market will have the most advanced products in the world, and:

- The productive and developmental processes presented indicate that these are industrial projects and not simple assembly projects.

Various companies presented bid offers for more than one segment: Sisteco s.a. (4); CNL Bull S.A. (3); Itron S.A. (3); Microsistemas S.A. (2); and Industria de Alta Tecnologia S.A. (2). A quick reading of the names of the companies reveals the participation in the bidding of several with a

background in the informatics area: Target S.A.; Basis S.A.; Radio Victoria Informatica A.A.; Proceda S.A.; Keydata S.A.; Facema S.A.; Czerweny Electronica S.A.; Sistemas Digitales S.A. and Fimpar S.A., as well as the offer from a medical specialties laboratory: P.L. Rivero and Co. S.A.

According to the announcement of Engineer Lacerca at the aforementioned ceremony, the Secretariat of Industry will soon submit the new rate system for the electronics industry to the Ministry of Economy and will complement the promotional action with a competitive bid for that sector and another for communications. The scheduled dates are next 30 July and 15 August.

"By establishing in each sector those segments on which the principal role of the majority-national-capital companies and the purchase and generation of the most appropriate technology for the country should be based," we are defining the rules of the game of the electronics industry, declared Lacerca.

8711
CSO: 5500/2097

ARGENTINA

INFORMATICS CENTER TO EXPAND TRAINING PROGRAM

Buenos Aires CLARIN in Spanish 25 Jun 85 p 32

[Text] In recent weeks, the National Technical Education Council (CONET) conducted various activities connected with the training of technicians in various parts of the country. Among the main tasks are programs begun in Tucuman and Catamarca, the signing of an agreement with Germany and the intensification of dissemination of informatics.

CONET's director general of professional training, Guido Carlo, recently signed an agreement with the National University of Tucuman (UNT) and with the Provincial Health System (SIPROSA) for personnel training, qualification, reconversion, advancement and specialization projects. It also includes the offering of adult training courses for instructors and workers in bricklaying, carpentry, mechanics, etc. through the support of teachers and material from National Occupational Training Center No 1 of Tucuman.

In Catamarca, the National Technical Education School No 1 was officially inaugurated in the town of Santa Maria with the presence of the governor of the province, Ramon Saadi, and CONET director of technical training, Jorge Brescia. The support of the local community was prominent in the construction of the project inasmuch as the school workshop was built through the municipality.

In the framework of the bilateral technical cooperation agreement between the governments of Argentina and the Federal Republic of Germany, a new educational experiment called Dual-System (Work-Study) Project was approved for the training of skilled personnel in various jobs and occupations typical of the industrial sectors and services. Approximately 1,500 Argentine students will participate in it.

At the same time, the National Informatics Teaching Center (CENEI), an agency of CONET, continues to expand the plan for qualifying personnel in the new technologies in various schools throughout the country, having announced that these will total 158 establishments this year.

8711
CSO: 5500/2097

ARGENTINA

BRIEFS

NEW RADIO STATION--San Salvador de Jujuy, 9 Jul (TELAM)--The new radio station LR22 Radio C iudad Perico of the company Radio Vision Jujuy S.A. located in Perico, 30 km from here, has begun its testing stage. The official inauguration will be held on 15 July. The station operates at 1410 KHZ, has a 51-meter antenna and uses a 1-kw transmitter. /Summary/ /Buenos Aires TELAM in Spanish 1842 GMT 9 Jul 85/

TELECOMMUNICATIONS PERSONNEL--Buenos Aires, 23 Jul (TELAM)--Juan Higinio Ciminari and Jorge Horacio Carnelli have been installed as the new under-secretaries of radio braodcasting and telecommunications respectively. /Summary/ /Buenos Aires TELAM in Spanish 1816 GMT 23 Jul 85/

INTERNATIONAL COMMUNICATIONS VICE PRESIDENT--Ramon Baldassini, secretary general of the Federation of Postal and Telecommunications Workers, was named vice president of the Communications, Radio and Television Personnel International /La Internacional del Personal de Communicaciones, Radio y Television/ during a congress held in Interlaken Switzerland). /Summary/ /Madrid EFE in Spanish 2003 GMT 21 Sep 85/

LAND-BASED SATELLITE STATION--San Salvador de Jujuy, 24 Sep (TELAM)--A land-based satellite communication station has been dedicated in Jujuy Province, in the locality of Lozano, 18 km north of San Salvador de Jujuy. This is the province's fourth station of its kind. /Summary/ /Buenos Aires TELAM in Spanish 1119 GMT 24 Sep 85/

CSO: 5500/2001

BARBADOS

BRIEFS

RADIO SERVICE CUTBACK—Bridgetown, 28 Sep (CANA)—The Eastern Caribbean's sole round-the-clock radio service will end Monday when the Caribbean Broadcasting Corporation (CBC) cuts back its operation by 4 1/2 hours. An announcement over CBC-AM radio said the station, formerly known as Radio Barbados, would operate for 19 1/2 hours, from 5:30 A.M. until 1 A.M. No explanation was given for the decision. CBC's main competitor, the Independent Voice of Barbados, starts its broadcasting day half an hour earlier. The government-owned corporation also operates an FM radio service and the island's lone television station. [Text] [Bridgetown CANA in English 1649 GMT 28 Sep 85 FL]

CSO: 5540/1

DOMINICA

DLP PRESSURES GOVERNMENT TO RESUME BROADCASTS OF PARLIAMENT

Port-of-Spain SUNDAY GUARDIAN in English 15 Sep 85 p 4

[Text] BRIDGETOWN, Sat., (Cana): THE Opposition Dominica Labour Party (DLP) plans to step up the holding of public meetings islandwide over the next few weeks and organise a demonstration in the capital to pressure the government into resuming live radio broadcasts of Parliamentary proceedings, a spokesman said here today.

DLP executive members and representative for the Paix Bouche constituency, Rosie Douglas, told reporters the decision of the Eugenia Charles administration to halt live coverage of sittings of the House of Assembly underminded the democractic process and could lead to extra-parliamentary and other revolutionary activity.

In a country (like Dominica) where you do not have the large reading public as you have in Barbados, ...the question of participatory democracy, the question of mass participation, the question of involvement in the democratic process is seriously threatened in Dominica at the present time, the left-wing politician told a news conference.

The dispute reached a head during last month's budget debate when the six DLP Opposition members walked out of Parliament after the Government decided the entire proceedings would not be aired live. The government said some Members of Parliament misuse radio time.

Douglas said DLP representatives had a meetings with Prime Minister Charles on the issue, but government had failed to respond by yesterday as promised and the party would resume agitating for the resumption of live broadcasts.

Douglas, brother the DLP leader Michael Douglas, said he contested the July 1 general elections on a United Dominica Labour Party (UDLP) ticket for tactical reasons because some DLP members feared his leftist stance could have jeopardised the party's chances of victory.

Douglas, who openly professes close ties with radical countries including Libya and North Korea, was branded a Communist by campaign speakers for the ruling Dominica Freedom Party (DFP). He denied being a Communist today, describing himself as a left social democratic politician.

Douglas, intransit through Barbados, said he officially represented the DLP in Parliament and was speaking on its behalf.

He said DLP Parliamentarians planned to turn up for the next sitting of the House of Assembly on September 23, bct the boycott would remain in force unless government changed its mind.

CSO: 3298/1030

JAMAICA

BROADCASTING CORPORATION LAYOFFS, SERVICE CUTS CONTINUE

JBC Actions

Kingston THE DAILY GLEANER in English 31 Aug 85 pp 1, 3

[Text] The Jamaica Broadcasting Corporation (JBC) will make 86 workers redundant tomorrow and cease operations at Radio Central (Mandeville) and Radio North East (Ocho Rios). Cost of the redundancy programme has been put at over $850,000.

This latest round of the Corporation's redundancy programme, said to be geared at reducing operational cost by $1.7 million up to March next year, follows the sacking two weeks ago of 25 temporary workers.

The number of staff at the Corporation will stand at 179 after Sunday.

Workers in all departments of the Corporation, except the newsroom, engineering and accounts departments, have been affected as well as the operations of Radio Central and Radio North East.

Both community radio stations received telephone calls yesterday to cease broadcasting immediately. Radio West, the third community station, will continue to operate.

The entire Sports Department of JBC has been scrapped and some of the staffers transferred to the newsroom.

The **Gleaner** understands that workers in the Accounts Department of the JBC are also slated to be axed, but management is awaiting the installation of computers to replace them.

A release from the Corporation signed by the general manager, Mrs. Gloria Lannaman, said yesterday:

"Following the reorganisation and restructuring which has been going on at the JBC over the past months, it has been found necessary to reduce operational expenditures in certain areas, including staff. This process is in line with steps being taken throughout the public sector to achieve a greater degree of cost effectiveness.

"Effective 1st September 1985, the operation of Radio Central and Radio North East will cease; JBC will contract out most of its local production; and a new basis is being put in place to accommodate new sales and marketing strategies.

"The resultant effect of these measures will reduce staff levels from 265 to 179 representing a reduction in operational cost upwards of $1.7 million to March 1986. These persons will benefit from redundancy payments in excess of $850,000, and in accordance with the union agreement will be eligible for free-lance contractual work with the JBC where possible."

New JBC Chairman

Kingston THE DAILY GLEANER in English 4 Sep 85 p 1

[Text]

GEORGE MCWHINNIE ABRAHAMS, the new JBC Board Chairman is the Public Relations and Special Projects Manager of the J. Wray and Nephew Group of Companies which he joined 29 years ago, and recipient of the Prime Minister's Medal of Appreciation in 1983. He is also a Justice of the Peace for St. Andrew.

Mr. Abrahams serves on the Board of the Jamaica Cultural Development Commission; is Chairman of the Committee of Friends of the Bustamante Hospital for Children; a Trustee of the West Kingston Trust, and a member of organisations in education, horse-racing and breeding, as well as bird-shooting.

As a former Deputy Chairman of the previous JBC Board, Mr. Abrahams played an important role in the change-over from black and white to colour television in the Island, and was on the negotiating team for the development of Jamaica's Earth Station and Satelite.

He is a past President of the Clarendon College Old Students Association; a member of the Jockey Club of Jamaica, the Manchester Golf Club and the Hill Run Gun and Fishing Club, of which he is also a past President.

CSO: 3298/1046

JAMAICA

PNP OBJECTS TO SEAGA'S BROADCASTING DIVESTMENT PLAN

Port-of-Spain TRINIDAD GUARDIAN in English 7 Sep 85 p 5

[Text] KINGSTON, Fri., (Cana): THE Opposition People's National Party (PNP) says it is fundamentally opposed to Government's new policy to divest sections of the state-owned Jamaica Broadcasting Corporation (JBC).

PNP General Secretary Dr Paul Robertson said the electronic media policy announced Tuesday by Prime Minister Edward Seaga as it related to the JBC was illegal and divestment proposals should be withdrawn.

There was no provision in the law which gave Government or the Prime Minister authority to arrogate the functions of the JBC Board or to divest its broadcasting licence, he said.

Mr Seaga announced this week that the JBC would operate a national FM Radio Service and television station with morning television being run by a private company from Monday to Friday for about three hours daily.

EARNINGS

The JBC AM Radio Service would be operated by other private interests which would also manage three regional radio stations, two of which were closed last week when about 80 staffers were dismissed.

Dr Robertson blamed managerial errors and the public loss of credibility because of what he alleged was blatant JLP political propaganda projected in JBC's news reports and public affairs, for a drop in the station's listenership from more than 40 per cent in 1980/'81 to just over 20 per cent this year.

Dr Robertson said better management and radio programming could have improved listenership and commercial earnings. Profits earned from television could be used to make the corporation financially viable, thus negating the need to terminate the employment of experienced staffers, he added.

He said the PNP was concerned about the absence of any announced criteria by which the JBC services would be divested and added that this was an open door to corruption.

Dr Robertson also brushed aside references by the Prime Minister of excessive staffing at JBC, saying that this was caused by the corporation's recruitment policies over the last few years.

He also criticised the agency for breaking what he called traditional labour practices by making workers with more than ten years redundant while retaining staff with less than four years service.

Mr Seaga also announced that a new public broadcasting corporation will be set up and the government will sell some of its 25 per cent shareholding in the second radio station, Radio Jamaica, among other initiatives.

CSO: 3298/1018

GABON

BRIEFS

CAPTAC MEETING ENDS--Libreville, 29 Sep (AGP/PANA)--The Conference of Ministers of Central African Posts and Telecommunications Administrations [Conference des Ministres des Administrations des Postes et Telecommunications d'Afrique Centrale] (CAP-TAC) which opened on Friday, ended in Libreville on Saturday. According to the final communique issued at the end of the session, deliberations centered on topics related to training of posts and telecommunications staff and the need to intensify exchanges of information between member-states in order to bring about a Pan-African Telecommunications Network [Pan-Africain de telecommunications] (Panaftel). Emphasis was also placed on mail distribution and recommendations were made on training and coordination at the level of Central African countries, with a view to improving staff performance. The council asked the CAPTAC General Secretariat to examine, with the cooperation of the Customs and Economic Union of Central Africa, the possibilities of setting up a telecommunications engineering school in Central Africa. It urged countries in the subregion to interconnect their telecommunications networks. [Excerpt] [Dakar PANA in French 1335 GMT 29 Sep 85]

CSO: 5500/3

STOVANOVIC ON PROGRESS OF SATELLITE FREQUENCY CONFERENCE

Geneva JOURNAL DE GENEVE in French 10 Sep 85 p 3

[Interview with Professor Stovanovic, by P.-E. Dentan]

[Text]"Each and every country is entitled to at least one orbital frequency." This is the fundamental principle accepted by the participants to the conference on the sharing of available frequencies, we are told by its chairman, Professor Stovanovic.

Gracious and modest, despite his universitary titles and his scientific reputation, which has spread beyond the Yugoslav borders, Professor Stovanovic has chaired since 8 August in Geneva, the important UIT (International Telecommunication Union) conference on sharing the frequencies available in geostationary orbit. Professor of telecommunications at the University of Belgrade, Mr Stovanovic has not hesitated in recent weeks, to spend entire nights and weekends in attempting to reconcile different viewpoints.

These points of view reach beyond the customary political lines, since they concern large amounts of money for satellite users, operators, and manufacturers. When we realize that a single geostationary satellite can "spray" one-third of the earth's surface, it is easy to understand the political stakes in such a propaganda--or commercial--instrument, as well as the problems created by the operation of these satellites, which can be neutralized by interference. Several days before the end of the conference, we asked its chairman whether it would achieve its goals.

[Answer] We have reached a first agreement on principle: every and any country is entitled to at least one orbital position with a corresponding carrier frequency. Having accepted this fundamental principle, we have not yet reached agreement on the frequency bands to be planned. One group of countries believes it is sufficient to plan the 6/4 bands, while another aims at all the bands. But I remain optimistic after having formed a "friends of the chairman group" which seeks to reconcile national--or commercial--interests.

[Question] Are the systems already in operation insufficient?

[Answer] Intelsat for instance, is connected to 157 countries. But the share of American capital in this enterprise has gradually dropped to only 20 percent. Inmarsat is connected to 3700 ships; Intelsputnik connects the CEMA countries; and Arabsat, launched by Ariane, will undoubtedly be a good business. And the last satellite placed in orbit, Ausat (Australia) (editor's note: August, $203 million), is a useful one.

The total orbit must be divided into 12 existing fixed services: radiocommunication and television satellites; satellites used for mobile services (ships and planes), research, land exploration, meteorology, and frequency transmission; not to mention government satellites and those of the international association of radio amateurs, of which there are three already! National satellites must also be included: Anik, which services Canada; Palapa, which interconnects all the islands of the Indonesian archipelago; and the Indian satellite. Given the magnitude of its Saharan territory, Algeria wants to have its own satellite. Other projects are under study for all the African countries, with two organizations fighting over the market, which does not make matters any easier.

Political Questions

A believer in international solutions, Mr Stovanovic points out that the 1977 conference on satellite radiocommunication had accepted the principle of beams which would cover only national territories. Very lively debates had arisen at the UN on the free flow of information. But the decision was reached to consider only national transmitters, except for prior consent.

Although it is a technical conference, the UIT meeting with its 1100 participants cannot avoid political issues. It had to consider the problem raised by the jamming of land stations. It almost reached agreement by issuing to its supporting technicians, the necessary instructions for calculating relationships between the utilization of the energy dispersion in region 2 (the Americas) and the limits of what is known as "the surface power of space stations." But this is only the beginning of a solution to all these problems, at the principle level. It is already a feat to have (almost) mastered them.

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